Original Research

Sheep production systems, challenges and opportunities at Horro district, Horro Guduru Wallaga zone, Oromia, Ethiopia: A review

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Abstract	Article Information
The review was conducted on sheep production systems, challenges, and opportunities in the Horro district of the Horro Guduru Wallaga zone, Oromia, Ethiopia. The objectives of the review were to characterise sheep production systems and investigate the challenges and opportunities of sheep production in Horro district. Different publications pertinent to the Horro sheep breed were consulted, and reports of the Horro district office of agriculture were also consulted, with particular emphasis on grazing, health, housing, and breeding management. Mixed crop-livestock production is the major production system in Horro district. Sheep are the second-most important livestock species raised in the district, next to cattle. Major feeds are natural pasture, crop residues, and crop aftermath in that order of importance. The primary style of feeding in the area is open grazing on communal grazing lands. Herding is common during the cropping season, and neighbouring households share the responsibility of looking after the mixed species of animals by taking turns. Animals are left free to roam during the remaining part of the year after the harvesting season. Sheep are kept in either separate houses or family houses during the night. The knowledge gap with regard to record keeping and conservation of feeds, the selection of breeding males and females, and the use of selected animals is the most important gap identified. In addition, liver fluke and seasonal shortages of feed are some of the problems for sheep production in Horro district. The presence of the Horro sheep breed, which is believed to originate from the area, and the presence of Wallaga University right at the heart of the sheep breed's ecological niche, the Horro Guduru Wallaga zone, may be some of the major opportunities to improve the productivity of the sheep breed and enhance the livelihoods of smallholder sheep producers. In addition, the presence of a community-based sheep-breeding programme in two of the Horro Guduru district's PAs and the possibility of optimising and scaling up the experience to wider areas are other big opportunities. Horro district is also one of the potential cereal and pulse crop producing areas due to its agro-ecology, thus its high potential for crop residues. Generally, the findings of the current review have to be considered in any genetic improvement intervention in Horro district and areas with similar production environments.	 *Corresponding Author: Gemeda Duguma E-mail: gdjaallataa@yahoo.com

INTRODUCTION

Sheep are the most economically important livestock species in Ethiopia. Sheep play a significant role in the livelihood of resource-poor farmers and pastoralists. They have special features like efficient utilisation of marginal and small plots of land, a short generation interval, a high reproductive rate, a low risk of investment, and more production per unit of investment compared to cattle (Rege, 1994; Dixit et al., 2005). Ethiopia has 14 traditional sheep populations and nine identified sheep breeds (Gizaw, 2008). There are about 42.9 million sheep in the country, out of which about 70% are females and about 30% are males. Duguma (2010) also reported that about 75%–85% of the four indigenous sheep breeds of Ethiopia (Afar, Bonga, Horro, and Menz sheep breeds) were composed of females.

Almost all (99.72%) of the sheep population of the country is indigenous, and only about 0.41% and 0.08% are hybrid and exotic (CSA, 2016). Regarding the age distribution, CSA (2016) reported that about 52.01% of the sheep population of the country is in the age group of two years and older and young stock less than six months, respectively.

There are different identified sheep breeds in Oromia. One of the identified sheep breeds is the Horro sheep. According to Galal (1983), the Horro sheep breed is widely distributed in the western part of Ethiopia, in the area that lies within 35° to 38° E and 6° to 10° N. The Horro sheep breed is raised for its meat and, thus, income generation. The colour pattern of the Horro sheep is plain. Their coat colour is brown, creamy white (tan), brown, and white. Duguma (2010) also reported that about 79% of Horro sheep are uniform in coat colour (brown, creamy white, or tan). The breed exhibits a facial profile difference between sexes; almost all females have straight faces, but in males, it is slightly convex. The nature of the breed's tail is fatty and triangular, with a relatively narrow base reaching just below the hock (Edea 2008). Both sexes are pooled with semi-pendulous ear types. Often, rams have a mane between the head and the brisket and above the neck and the shoulder. The mean height at shoulder for adult males and adult females is 73±1.3 and 68±0.8 cm, respectively (Galal 1983). Based on the large geographical areas where the Horro sheep breed is believed to inhibit and the statistical report on the sheep population residing in these areas (the then-Wallaga zone and Ilu Ababora, Jimma, and some parts of the west Shewa zones), it can safely be assumed that the breed is not at risk of extinction (Abegaz & Duguma, 2002). The breed was reported to be the second largest in terms of population density, amounting to 3,409,300, next to Arsi-Bale sheep (Gizaw 2008).

Under on-station conditions, research on the characterization, production, and reproduction performances of Horro sheep has been conducted since the mid-1970s. However, no exhaustive production system characterization or evaluation of existing challenges and opportunities is done under smallholder farmers' management conditions for the Horro sheep breed. However, sustainable breed improvement strategies need

to be tailored to the specific goals of the targeted communities and production systems or environments, as no single strategy fits all situations (Duguma, 2010). According to the author, the prevailing production conditions largely determine the breeding or production purposes, suitability of breeds, and breeding methods. Thus, the current study was conducted to characterise sheep production systems and to determine existing challenges and opportunities for sheep production in the Horro district of the Horro Guduru Wallaga zone.

METHDOLOGIES EMPLOYED
Description of study areas

The current study was focused on the Horro district of the Guduru Wallaga zone, Oromia, Ethiopia. Horro district lies between $9^0 34´$ N latitude and $37^0 06´$ E longitude. The district covers a total land area of about 77,998 ha, of which grazing land is 8.3%. The proportion of highland, midland, and lowland areas in the district is about 49.8%, 48.89%, and 1.24, respectively (Duguma et al., 2012). The district experiences a unimodal type of rainfall that extends from March to mid-October, with a mean annual precipitation of about 1800 mm (Olana, 2006). The mean maximum and minimum temperatures of the district are 22.7 °C and 11.8 °C, respectively. A mixed crop-livestock production system is the common farming practise in Horro district. Major crops grown in the area are barley, wheat, pulses, and teff.

Data collection
Different publications pertinent to the Horro sheep breed were consulted. Reports of the

Horro Guduru Wallaga Zone Office of Agriculture were reviewed, with particular emphasis on grazing, breeding, health, housing, and breeding management. Regarding breeding management, selection of breeding rams and ewes, use of breeding rams, culling and recording, and record keeping was among the focuses given.

Findings and Discussions
Production system
Crop-livestock mixed production is the major system in Horro District. Sheep are the second-most important livestock species raised in the district, next to cattle. Cattle are kept mainly for draught power, followed by milk production. Major feeds are natural pasture, crop residues, and crop aftermath. Feed processing is not widely practised in Horro district other than the collection and conservation of residues from some crops by some households (Duguma et al., 2012).

Landholding per household in Horro district
Based on data collected from three PAs in Horro districts, the average landholding per household ranged from 1.6ha to 2ha (Duguma et al., 2012). However, seven years later, Bekana (2019) reported an average landholding of about 1.78±1.51/household, ranging from 1.74±1.62 to 1.83±1.40 for two of the three Peasant Associations (PAs) reported by Duguma et al. (2012). It seems that landholding per household has shown a decreasing trend from 2012 to 2019. The likely reason for the decreasing trend may be that newly emerging households that did not possess land might have settled on some of the

lands previously owned by their parents. Bekana (2019) also reported that landholding size per household has been decreasing, and he attributed the landholding size reduction to human population pressure. Due to population pressure and newly emerging households, large areas of swampy lands that used to serve as communal grazing lands are currently serving as residence areas (personal observation). Bekana (2019) also reported that most of the communal grazing areas, which were used to serve as sole grazing lands during 2008/09, were encroached upon by crop cultivation and the construction of houses for different purposes. Some of the PAs in Horro district are irrigable, and some are not. For instance, Gitlo and Laku Igu PAs have irrigable areas, but PAs such as Oda Buluq have no irrigable lands, mainly due to the absence of perennial rivers suitable for irrigation (Duguma et al., 2012). According to Bekana (2019), old-age farmers above 60 years of age occupied more plots of land. Demisu et al. (2013) reported 3.6 ha of average landholding per household in the Guduru district of Horro Guduru Wallaga zone, Oromia.

Sheep flock size and structure

In the current study, sheep flock size is defined as total number of sheep possessed per household in the study district. On the other hand, flock structure is the proportion of the flock that is formed by different sexes and age classes. The average sheep flock size per household reported for Horro district ranged from 8.2 to 17.4 (Edae, 2008; Duguma, 2010). Edea (2008), who covered a wide area of

Horro district, reported an 8.2 average flock size per household. Two years later 17.4 head of sheep per household was reported by Duguma (2010) who did sheep inventory from 120 households of two PAs of the district. Bekana (2019) also reported average sheep flock size of 13.9 per household from two PAs of Horro district. The likely reason for the difference may be the area covered and the sample size used. An average flock size of 15.9±9.86 was also reported from a survey study conducted in the Horro Guduru Wallaga zone of the Oromia region (Demissu and Gobena, 2015).

With regard to sheep flock structure, Duguma (2010) reported that 79% of Horro sheep flocks in Horro district were female and 21% were male. About nine years later, Bekana (2019) reported that female and male sheep constituted about 72.1% and 27.9% of the flocks in Horro district, respectively. The proportion of female and male Horro sheep obtained by Bekana (2017) was in disagreement with the proportion reported by Duguma (2010) during the initial phase of the community-based breeding project (CBBP) for the same sheep breed. The likely reason for the difference may be genetic intervention by the CBBB, which might have changed flock structures. Abegaz et al. (2005) also reported that breeding females of the Horro sheep breed older than one year of age constituted about 47% of the total flock. About 42–52.5% of breeding ewes with at least one pair of permanent incisors were also reported for the Menz sheep breed (Agyemang et al., 1985; Mukasa-Mugerwa et al., 1986; Wilson, 1991; Mekoya et al., 2000; Duguma,

2010). Breeding rams with one or more pairs of permanent incisors was only about 0.68% in Horro flocks in 2009, and the male-to-female ratio was 1:70 (Duguma, 2010). A critical shortage of breeding rams in the flocks of Bonga and Horro sheep breeds was also reported (Edea, 2008; Duguma, 2010). According to the authors, the major cause of the critical shortage of breeding rams in Horro and Bonga flocks was the early disposal of ram lambs. However, Bekana (2019) reported a breeding male-to-breeding female ratio of about 1:11 for the same villages and the same sheep flocks reported by Duguma (2010). The improvement in retention of breeding males in flocks was done by intervention from the establishment of a community-based sheep-breeding programme at Gitlo and Laku Igu villages in Horro district in 2009. With regard to the members of the community-based breeding programme (CBBP), there are enough breeding males in the flocks. The male-to-female ratio commonly used under controlled breeding at Bako Agricultural Research Centre is 1:20 to 25.

Purpose of keeping sheep
Smallholder producers raise sheep for marketable and non-marketable benefits. Duguma et al. (2011) indicated that non-marketable or intangible benefits are concealed when one uses conventional breeding objectives valuation methods. In the current study areas, sheep are kept mainly for income generation, meat, and manure for crop production. Though no one purposefully kept sheep for manure production, having sheep for manure smallholder farmers in Horro district (Edea, 2008) ranked production higher.

According to the author, functions such as ceremony and saving relatively received lower ranking values compared to meat, income generation, and manure both in Horro district and Adiyo Kaka district of the Kafa zone, Southern Nations Nationalities and Peoples Regional State. Duguma et al. (2012) also reported that sheep producers in Horro district raise sheep for income and manure production. Similarly, Gobena (2018) reported that smallholder farmers from the Guduru district of Horro Guduru Wallaga zone in the Oromia region raise sheep for income, meat production for home consumption, and manure.

Growth and Reproduction Performances of Horro Sheep under Farmers' Management
The profitability of a sheep production enterprise is determined by both reproduction (fertility) and production traits (growth (Nagy et al., 1999) Growth and reproduction performance traits of sheep are traits of economic improvement for sheep genetic improvement interventions. Furthermore, reproductive performance is also a major contributing factor to the efficacy of sheep meat production. According to Duguma (2001), enhancement of the reproductive capacity of sheep flocks is among the most effective mechanisms for increasing overall meat production.

Growth performance
One of the most economically important production traits is growth, which is commonly indicated by body weight measured at different ages. The Horro sheep breed, the common sheep breed in Horro district, is one

of the largest and most prolific indigenous sheep breeds in Ethiopia (Galal, 1983). Sheep body weight is commonly measured at birth, weaning, six months, and one year, but recorded information on body weight at different ages is not available under on-farm management. Bekana (2019), who analysed data collected by the Bako Agricultural Research Centre on flocks of Horro sheep managed under a community-based sheep-breeding programme at two PAs in Horro district, reported an average birth weight of 2.83±0.66 kg. The mean birth weight reported by Bekana (2019) for Horro sheep managed under on-farm management is higher than the mean birth weight ranging from 2.6 to 2.7kg reported in the literature (Abegaz et al., 2000; Alemayehu et al., 2017) for the same sheep breed managed at Bako Agricultural Research Centre. The authors used data collected from 1977 to 2011, and lambs were also weighed by skilled technical staff within 24 hours after birth. However, the duration of data collection was short (2009–2019), and data was collected by a hired enumerator, who could not manage to capture the birth weight of lambs from households within 24 hours after birth with regard to Bekana (2019). The other likely difference in birth weight between the on-farm and on-station flocks may be a location difference. Bekana (2019) conducted his study at Horro Highland (altitude range 2170–2853 m.a.s.l.), which is believed to be the natural habitat of the breed, whereas flocks managed at Bako Agricultural Research Centre are maintained in a warm, humid midland area (altitude range 1579–1789 m.a.s.l.). The on-farm birth weight reported by Bekana (2019)

for Horro sheep managed under on-station conditions was also higher than lamb birth weight reported in the literature (Taye et al., 2010; Amare et al., 2018), but lower than the 3.6 kg reported for Bonga sheep (Metsafe, 2015). The likely explanation for the differences may be breed and location effects.

Weaning weight is a trait of great economic importance in meat sheep production as it influences growth rate and survival (Taye et al., 2009). Weaning weight is also important in breeds such as Horro sheep, which are marketed at about weaning age. Duguma (2010) reported that he was unable to find 15 breeding males for the animal ranking experiment in Horro district because fast-growing males are sold early, at about three to four months of age. The author reported a breeding male to female ratio of 1:70, indicating that fast-growing male Horro sheep are sold early. Bekana (2019) reported an average weaning weight of 12.5±2.81kg under on-farm conditions in Horro district, which was consistent with the 12.2±2.62kg and 11.8±0.09kg reported for Horro sheep maintained under on-station management by Alemayehu et al. (2017) and Abegaz et al. (2000), respectively. A similar weight of 12.4kg was also reported for the Washera sheep breed evaluated under on-farm management (Taye et al., 2010). However, the 15.5kg weaning weight reported by Metsafe (2015) for lambs of the Bonga sheep breed managed under on-farm management was higher than the 12.2±2.62kg reported by Bekana (2019) for lambs of the Horro sheep breed. Literature reports indicate that sex, birth type, ewe parity, and breed (Taye et al., 2019; Alemayehu et al., 2017) affect weaning weight.

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Six-month weight is the weight of lambs measured during the post-weaning period, when lambs are independent of their dams and totally rely on feeds available in the surrounding area. Different values were reported with regard to the six-month weight of Horro lambs under on-station management. Alemayehu et al. (2017) reported an average six-month weight of 16.0±3.16kg under on-station management. A nearly similar value (16.48±2.55kg) was also reported for the same sheep breed under on-farm management conditions (Bekana, 2019). The 22.2kg six-month weight reported for Bonga sheep is higher than the on-farm and on-station six-month weight reported for Horro sheep.

Information on yearling weight and mature body weight is scanty under on-farm conditions. Duguma (2010), who collected information from 4 males and 148 ewes of Horro sheep of one to two pairs of permanent incisors that were managed under on-farm management conditions, reported 31.2±1.79kg and 26±0.31kg, reportedly. A mean yearling weight of 26.1±6.41kg (28±0.25kg for males and 24±0.23kg for females) was also reported for the same breed under on-station management (Alemayehu, 2017), who analysed data collected for more than three decades. An average live weight of 28.2±0.23 was also reported for the same breed in Guduru District of Horro Guduru Wallaga Zone of Oromia Region (Gobena, 2018).

Reproduction performances

Reproductive performance is also a major contributing factor to the efficacy of sheep meat production. Enhancing the reproductive capacity of sheep flocks is among the most effective mechanisms for increasing overall meat production. Some of the most economically important reproductive traits are age at first lambing, lambing interval, litter size, and lamb survival.

Age at first lambing (AFL)

The average age at first lambing reported for Horro sheep flocks managed under on-farm management in Horro district was 16 months (Bekana, 2019). Edea (2008), who conducted a characterization study at Horro district, reported an average age of 13.3±1.70 months for the age at first lambing for the same breed. Horro ewes provided preferential nutritional management at Bako Agricultural Research Centre gave birth at about one year (Galmessa et al., 2013), indicating that management, particularly nutrition, plays a significant role in age at first lambing. It is believed that early lambing may increase the number of lambings per lifetime of ewes. Edea (2008) reported 14.9±3.10 months mean age at first lambing for Bonga ewes. Bekana (2019), who summarised literature information on about 12 indigenous sheep breeds in the country, reported an age at first lambing ranging from 9.6 to 24.4 months. The differences in age at first lambing among the different sheep breeds situated in different parts of the country may be indications of breed, management, and location differences.

Lambing Interval (LI)

The lambing interval is the time gap between consecutive lambings. Management, breed, and the availability of breeding rams in the

flock influence lambing interval. Lambing intervals ranging from 7.8 to 8.8 months were reported for Horro sheep under on-farm management conditions (Edea, 2008; Bekana, 2019) based on actual data recorded for about a decade and survey data. Average lambing intervals ranging from 7.8 to 12.9 months were also reported by Bekana (2019), who reported landscape reviews on different indigenous sheep breeds in Ethiopia.

Litter size (LS)

Horro sheep is one of the most prolific indigenous sheep breeds in the country (Galal, 1983). Litter size, which is highly dependent on ovulation rate, has a high economic value and is a fundamental reproductive trait in small ruminants. Litter size at birth is a combination of ovulation rate and embryo survival and is calculated as the ratio of lambs born to the number of ewes lambing in a given year. Based on data collected for a decade (2010–2019), an average litter size of 1.32 was reported from Horro district (Bekana, 2019). The author reported mean values of 1.40 and 1.19 for the ewes of Gitlo and Laku Igu PAs, respectively. Edea (2008) reported an average listed size of 1.40 for the same breed, but from a wider area of Horro district. Bekana (2019), who summarised literature reports of survey studies conducted in different parts of the country at different times, reported average litter size values ranging from 1.04 to 1.50 for different indigenous sheep breeds.

Lamb survival rate

Lamb survival to weaning is the most important trait for sheep production, as it is an almost marketable age. According to Duguma (2001), environmental conditions and management practises are expected to make a considerable impact on lamb survival. Bekana (2019) reported a 93% lamb survival rate based on data collected from 2010–2018 at on-farm conditions in Horro district. In line with this, a survival rate of about 87% was reported for the Bonga sheep breed under on-farm management conditions (Metsafe, 2015). Lamb survival is influenced by the birth weight of lambs. Literature reports indicated that lighter lambs at birth had a higher mortality rate (Abegaz et al., 2005; Duguma, 2001).

Current sheep management practises
Major feed resources

Major feed resources in Horro district are natural pasture, crop residues, crop aftermath, green fodder, or hay prepared from natural pasture, in that order of importance (Duguma et al., 2012). Grazing (natural pasture) is the most important feed source in the district. Plenty of crop residues are produced in the district every year. According to Duguma et al. (2012), about 6.3 to 11.7 tonnes of crop residues per household were estimated to be produced, but only a few farmers conserve and use the residues of some crops like teff, barley, and wheat. Cultivation of improved forage crops and the purchase of supplementary feeds are not commonly practised in the areas.

Feeding management

Horro is a potential area for sheep production. The primary style of feeding in the area is

open grazing. Herding is common during the cropping season (from August to January). During this time, neighbouring households share the responsibility of looking after the mixed species of animals by taking turns. Animals are left free to roam during the remaining part of the year after the harvesting season, although family members continuously for fear of theft (Duguma et al., 2012) look after sheep. There are two types of grazing lands in the district: communal and private. The communal grazing areas are the most commonly exploited and depleted type because all livestock species found in the area are kept on them throughout the year. There are various reasons that exacerbate the pressure on this type of grazing land. For instance, the newly emerging households do not possess any size of grazing land. Besides, older households keep their animals on it, especially during peak seasons, in order to minimise labour demand for herding, whereas others do so in order to defer their private pastureland for later use. Thus, it is neither protected nor given any sort of management.

The majority of households in Horro District possess private grazing land. This is the most protected and well-managed pastureland compared to the other two. It is commonly used for milking cows and oxen. Sheep and horses do not have access to such a type of land, indicating that sheep have been ignored even though they are considered the most important species for immediate income generation in the area. Some participants confessed that the lower attention given to sheep was due to a lack of awareness.

Bekana (2019) indicated that declining land holdings per household, including grazing areas, resulted in feed shortages, which can be considered one of the most important challenges in the expansion of livestock production in general and sheep production in particular. The major reason for the declining trend of grazing lands and landholding per household is an increase in human and livestock populations, which resulted in the shrinking size of grazing lands and the depletion of feed resources. The decline in the size of grazing lands forced the community to use mostly the bottom swampy areas as the main pastureland where sheep contract liver fluke.

Housing and water management of sheep

Sheep are kept in either separate houses or family houses. They are more protectively housed because of their fear of wild beasts, as farmers consider them defenseless compared to mature sheep (Duguma et al., 2012). Most of the time, sheep are either kept with calves or goats overnight in houses separately constructed or when they share family houses. The most important source of water for sheep in the Horro district is running water from rivers and, to some extent, tap water in urban areas.

Breeding management and major breeding objectives

Uncontrolled breeding is the common breeding practise in Horro district. No breeding females and breeding males selection is practised, except in two PAs where community-based sheep breeding is practised

on Horro sheep flocks. Even in those PAs, the distribution and management of breeding rams are not implemented as planned. Initially, the importance of sharing breeding rams to avoid inbreeding was well agreed upon by the community members, and different breeding ram groups were formed (Duguma et al., 2010). Body size, twinning, and lamb survival were the most economically important breeding objectives identified in two gandas of Horro district using different tools (Mirkena et al., 2011). Genetic improvement has been underway since 2009, focusing on those breeding objectives.

Major constraints

Duguma et al. (2012) identified knowledge-gap seasonal feed shortages and animal health as the most important problems for livestock production, including sheep. With regard to the knowledge gap, record keeping and conservation of feeds, the selection of breeding males and females, and the use of selected animals are indicated. Even in PAs where there has been intervention from institutions such as the Bako Agricultural Research Centre and the International Centre for Research in Dry Areas (ICARDA), breeding ram selection, fair distribution, management, and use of the selected breeding rams among the breed ram groups are well implemented. In the two PAs where community-based sheep breeding is underway, there is a critical shortage of breeding rams. This may negatively influence the reproductive performance of breeding ewes (Duguma et al. 2017). According to the authors, the proportion of older ewes that are

generally past their most productive stage was higher in the flocks than the more productive middle-aged ewes in Horro district, as well as in other regions and other sheep breeds such as Afar, Bonga, and Menz.

Various health problems are common in Horro district. One of the serious health problems is liver flu. Sheep contract liver fluke, a severe health problem in the area, from the swampy bottom grazing areas. In the area, it is hard to find sheep with an unaffected liver grazing on this type of pastureland (Duguma and Mirkena, 2009, unpublished data). With regard to its role as a source of feed, communal grazing land is the most overgrazed and hence depleted due to the numerous factors mentioned above. In addition, whatever amount of grass available is contaminated with feces due to the large number of animals standing on it for a longer time each day, and hence animals refuse to graze. There is also a great deal of trampling.

Opportunities

Horro sheep is believed to originate from the Horro area. The presence of the Horro sheep breed in the district, which is believed to be the ecological niche for the breed, is one of the different opportunities. The presence of enthusiastic and experienced smallholder farmers in sheep production and the presence of Wallaga University right at the heart of the sheep breed's ecological niche, Horro Guduru Wallaga Zone, may be some of the major opportunities to improve the productivity of the sheep breed and enhance the livelihoods of smallholder sheep producers. Horro district is one of the potential cereal and pulse crop producing districts due to its agro-ecology,

thus its high potential for crop residues. In addition, the presence of a community-based sheep-breeding programme in two of the Horro Guduru district's PAs and the possibility of optimising and scaling up the experience to wider areas is another big opportunity.

CONCLUSIONS

Mixed crop-livestock production is the major production system in Horro district. Sheep are the second-most important livestock species raised in the district, next to cattle. Major feeds are natural pasture, crop residues, and crop aftermath. Feed processing is not widely practised in Horro district other than the collection and conservation of residues from some crops by some households (Duguma et al., 2012). The primary style of feeding in the area is open grazing. Herding is common during the cropping season, and neighbouring households share the responsibility of looking after the mixed species of animals by taking turns. Animals are left free to roam during the remaining part of the year after the harvesting season, although family members continuously for fear of theft (Duguma et al., 2012) look after sheep. There are two types of grazing lands in the district: communal and private. The communal grazing areas are the most commonly exploited and depleted type because all livestock species found in the area are kept on them throughout the year. On the other hand, only draught oxen and milking cows are allowed to access the private grazing land.

Sheep are kept in either separate houses or family houses. They are more protectively housed because of their fear of wild beasts, as farmers consider them defenseless compared to mature sheep (Duguma et al., 2012). The knowledge gap with regard to record keeping and conservation of feeds, selection of breeding males and females, and use of selected animals is the most important gap identified. In addition, liver fluke and seasonal shortages of feeds (the latter mainly caused by the knowledge gap in feed conservation) are some of the problems for sheep production in Horro district. Generally, the findings of the current review have to be considered in any genetic improvement intervention in Horro district and areas with similar production environments.

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